



Sindy Tang

Associate Professor of Mechanical Engineering and, by courtesy, of Radiology
(Precision Health and Integrated Diagnostics)

Bio

BIO

Prof. Sindy KY Tang is the Kenneth and Barbara Oshman Faculty Scholar and Associate Professor of Mechanical Engineering and by courtesy of Radiology (Precision Health and Integrated Diagnostics) at Stanford University. She received her Ph.D. from Harvard University in Engineering Sciences under the supervision of Prof. George Whitesides. Her lab at Stanford works on the fundamental understanding of fluid mechanics and mass transport in micro-nano systems, and the application of this knowledge towards problems in biology, rapid diagnostics for health and environmental sustainability. The current areas of focus include the flow physics of confined micro-droplets using experimental and machine learning methods, interfacial mass transport and self-assembly, and ultrahigh throughput opto-microfluidic systems for disease diagnostics, water and energy sustainability, and single-cell wound healing studies. She was a Stanford Biodesign Faculty Fellow in 2018. Dr. Tang's work has been recognized by multiple awards including the NSF CAREER Award, 3M Nontenured Faculty Award, the ACS Petroleum Fund New Investigator Award, and invited lecture at the Nobel Symposium on Microfluidics in Sweden. Website: <http://web.stanford.edu/group/tanglab/>

ACADEMIC APPOINTMENTS

- Associate Professor, Mechanical Engineering
- Associate Professor (By courtesy), Radiology
- Member, Bio-X
- Faculty Fellow, Stanford ChEM-H

ADMINISTRATIVE APPOINTMENTS

- Associate Professor, Mechanical Engineering, Stanford University, (2018- present)
- Assistant Professor, Mechanical Engineering, Stanford University, (2011-2018)

HONORS AND AWARDS

- Faculty Fellow Award, The Reid and Polly Anderson Foundation (2011-2013)
- Junior Faculty Fellow Award, Gabilan (2011-2013)
- Petroleum Fund New Investigator Award, ACS (2013-2015)
- 3M Nontenured Faculty Award, 3M (2013-2015)
- NSF CAREER Award, NSF (2015-2020)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Editorial Advisory Board, Biomicrofluidics, American Institute of Physics (AIP) Publishing (2019 - present)
- Site Director, NSF Science & Technology Center for Cellular Construction (2017 - present)
- Co-lead of Bio Interfaces Focus Area, Stanford SystemX Alliance (2018 - present)

- Education Advisory Board, San Francisco Girls' School (2018 - present)
- Executive Technical Program Committee uTAS, The Chemical and Biological Microsystems Society (2018 - present)

PROGRAM AFFILIATIONS

- Stanford SystemX Alliance

PROFESSIONAL EDUCATION

- PhD, Harvard University , Engineering Sciences
- MS, Stanford University , Electrical Engineering
- BS, Caltech , Electrical Engineering

PATENTS

- Sindy KY Tang, Craig Criddle, Jaewook Myung, Minkyu Kim. "United States Patent App. 15,418,337 Emulsion-based fermentation for accelerated gas substrate mass transfer", Leland Stanford Junior University
- Sindy K.Y. Tang, Ming Pan, Fengjiao Lyu, Ratmir Derda. "United States Patent App. No. 14,922,018 Fluorinated pickering emulsion", Leland Stanford Junior University
- Ratmir Derda, Sindy K.Y. Tang, George M. Whitesides. "United States Patent 9,499,813 Systems and methods for amplification and phage display", Harvard University, Dec 11, 0189

LINKS

- Tang Lab: <http://stanford.edu/group/tanglab/>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Our lab is dedicated to solving problems at the interface of engineering, soft matter, and biology. Current focus includes microfluidics fundamentals and applications in disease diagnostics (e.g., tuberculosis, sepsis, allergy), and single-cell wound repair and learning. For details see <https://web.stanford.edu/group/tanglab/>

Teaching

COURSES

2018-19

- Introduction to Micro and Nano Electromechanical Systems: ENGR 240 (Aut)
- Introductory Fluids Engineering: ME 70 (Win)
- Optofluidics: Interplay of Light and Fluids at the Micro and Nanoscale: ME 321 (Win)

2017-18

- Introduction to Micro and Nano Electromechanical Systems: ENGR 240 (Spr)
- Introductory Fluids Engineering: ME 70 (Win)

2016-17

- Introduction to Micro and Nano Electromechanical Systems: ENGR 240 (Aut)
- Optofluidics: Interplay of Light and Fluids at the Micro and Nanoscale: ME 321 (Win)

2015-16

- Introduction to Micro and Nano Electromechanical Systems: ENGR 240 (Aut)
- Introductory Fluids Engineering: ME 70 (Spr)
- Optofluidics: Interplay of Light and Fluids at the Micro and Nanoscale: ME 321 (Win)

STANFORD ADVISEES

Master's Program Advisor

Chinmay Devmalya, Jefferson Dixon

Doctoral Dissertation Co-Advisor (AC)

Jefferson Dixon

Publications

PUBLICATIONS

- **Using machine learning to discover shape descriptors for predicting emulsion stability in a microfluidic channel.** *Soft matter*
Khor, J. W., Jean, N., Luxenberg, E. S., Ermon, S., Tang, S. K.
2018
- **Programming self-organizing multicellular structures with synthetic cell-cell signaling** *SCIENCE*
Toda, S., Blauch, L. R., Tang, S. Y., Morsut, L., Lim, W. A.
2018; 361 (6398): 156+
- **Microfluidic guillotine for single-cell wound repair studies.** *Proceedings of the National Academy of Sciences of the United States of America*
Blauch, L. R., Gai, Y., Khor, J. W., Sood, P., Marshall, W. F., Tang, S. K.
2017; 114 (28): 7283–88
- **Self-repairing cells: How single cells heal membrane ruptures and restore lost structures.** *Science (New York, N.Y.)*
Tang, S. K., Marshall, W. F.
2017; 356 (6342): 1022–25
- **Spatiotemporal periodicity of dislocation dynamics in a two-dimensional microfluidic crystal flowing in a tapered channel.** *Proceedings of the National Academy of Sciences of the United States of America*
Gai, Y., Leong, C. M., Cai, W., Tang, S. K.
2016; 113 (43): 12082–12087
- **Modified Micro-Emulsion Synthesis of Highly Dispersed Al/PVDF Composites with Enhanced Combustion Properties** *ADVANCED ENGINEERING MATERIALS*
Huang, S., Pan, M., Deng, S., Jiang, Y., Zhao, J., Levy-Wendt, B., Tang, S. Y., Zheng, X.
2019; 21 (5)
- **Timescale and spatial distribution of local plastic events in a two-dimensional microfluidic crystal** *PHYSICAL REVIEW FLUIDS*
Gai, Y., Bick, A., Tang, S. Y.
2019; 4 (1)
- **Cell learning.** *Current biology : CB*
Tang, S. K., Marshall, W. F.
2018; 28 (20): R1180–R1184
- **Phenotyping antibiotic resistance with single-cell resolution for the detection of heteroresistance** *SENSORS AND ACTUATORS B-CHEMICAL*
Lyu, F., Pan, M., Patil, S., Wang, J., Matin, A. C., Andrews, J. R., Tang, S. Y.
2018; 270: 396–404
- **Internal flow inside droplets within a concentrated emulsion during droplet rearrangement** *Physics of Fluids*
Leong, C. M., Gai, Y., Tang, S. K.
2018
- **Quantifying phenotypes in single cells using droplet microfluidics.** *Methods in cell biology*
Lyu, F., Blauch, L. R., Tang, S. K.
2018; 148: 133–59

- **Encapsulation of Single Nanoparticle in Fast-Evaporating Micro-droplets Prevents Particle Agglomeration in Nanocomposites** *ACS APPLIED MATERIALS & INTERFACES*
Pan, M., Shi, X., Lyu, F., Levy-Wendt, B., Zheng, X., Tang, S. Y.
2017; 9 (31): 26602–9
- **Towards a droplet radiometric assay for single-cell analysis.** *Analytical chemistry*
Gallina, M. E., Kim, T. J., Shelor, M., Vasquez, J., Mongersun, A., Kim, M., Tang, S. K., Abbyad, P., Pratz, G.
2017
- **High-Efficiency and High-Throughput On-Chip Exchange of the Continuous Phase in Droplet Microfluidic Systems.** *SLAS technology*
Kim, M., Leong, C. M., Pan, M., Blauch, L. R., Tang, S. K.
2017: 2472630317692558-?
- **Amphiphilic nanoparticles suppress droplet break-up in a concentrated emulsion flowing through a narrow constriction.** *Biomicrofluidics*
Gai, Y., Kim, M., Pan, M., Tang, S. K.
2017; 11 (3): 034117
- **Methods to coalesce fluorinated Pickering emulsions** *Analytical Methods*
Pan, M., Lyu, F., Tang, S. K.
2017; 9: 4622-4629
- **Encapsulation of Single Nanoparticle in Fast-Evaporating Micro-droplets Prevents Particle Agglomeration in Nanocomposites** *ACS Applied Materials & Interfaces*
Pan, M., Shi, X., Lyu, F., Levy-Wendt, B. L., Zheng, X., Tang, S. K.
2017; 9 (31): 26602–26609
- **Time-varying droplet configuration determines break-up probability of drops within a concentrated emulsion** *Applied Physics Letters*
Khor, J., Kim, M., Schütz, S. S., Schneider, T. M., Tang, S. K.
2017; 111: 124102
- **Internal flow in droplets within a concentrated emulsion flowing in a microchannel** *PHYSICS OF FLUIDS*
Leong, C. M., Gai, Y., Tang, S. K.
2016; 28 (11)
- **Confinement and viscosity ratio effect on droplet break-up in a concentrated emulsion flowing through a narrow constriction.** *Lab on a chip*
Gai, Y., Khor, J. W., Tang, S. K.
2016; 16 (16): 3058-3064
- **Low energy emulsion-based fermentation enabling accelerated methane mass transfer and growth of poly(3-hydroxybutyrate)-accumulating methanotrophs.** *Bioresource technology*
Myung, J., Kim, M., Pan, M., Criddle, C. S., Tang, S. K.
2016; 207: 302-307
- **Surface-functionalizable amphiphilic nanoparticles for pickering emulsions with designer fluid-fluid interfaces** *RSC ADVANCES*
Pan, M., Kim, M., Blauch, L., Tang, S. K.
2016; 6 (46): 39926-39932
- **Fluorinated Pickering Emulsions with Nonadsorbing Interfaces for Droplet-based Enzymatic Assays** *ANALYTICAL CHEMISTRY*
Pan, M., Lyu, F., Tang, S. K.
2015; 87 (15): 7938-7943
- **Actuating Fluid-Fluid Interfaces for the Reconfiguration of Light** *IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS*
Pan, M., Kim, M., Kuiper, S., Tang, S. K.
2015; 21 (4)
- **Quantitative detection of cells expressing BlaC using droplet-based microfluidics for use in the diagnosis of tuberculosis.** *Biomicrofluidics*
Lyu, F., Xu, M., Cheng, Y., Xie, J., Rao, J., Tang, S. K.
2015; 9 (4): 044120-?
- **Quantitative detection of cells expressing BlaC using droplet-based microfluidics for use in the diagnosis of tuberculosis** *BIOMICROFLUIDICS*

-
- Lyu, F., Xu, M., Cheng, Y., Xie, J., Rao, J., Tang, S. K.
2015; 9 (4)
- **Optofluidic ultrahigh-throughput detection of fluorescent drops.** *Lab on a chip*
Kim, M., Pan, M., Gai, Y., Pang, S., Han, C., Yang, C., Tang, S. K.
2015; 15 (6): 1417-1423
 - **Fluorinated Pickering Emulsions Impede Interfacial Transport and Form Rigid Interface for the Growth of Anchorage-Dependent Cells** *ACS APPLIED MATERIALS & INTERFACES*
Pan, M., Rosenfeld, L., Kim, M., Xu, M., Lin, E., Derda, R., Tang, S. K.
2014; 6 (23): 21446-21453
 - **Time capsule: an autonomous sensor and recorder based on diffusion-reaction.** *Lab on a chip*
Gerber, L. C., Rosenfeld, L., Chen, Y., Tang, S. K.
2014; 14 (22): 4324-4328
 - **Review and analysis of performance metrics of droplet microfluidics systems** *MICROFLUIDICS AND NANOFUIDICS*
Rosenfeld, L., Lin, T., Derda, R., Tang, S. K.
2014; 16 (5): 921-939
 - **Prospective identification of parasitic sequences in phage display screens.** *Nucleic acids research*
Matochko, W. L., Cory Li, S., Tang, S. K., Derda, R.
2014; 42 (3): 1784-1798
 - **Break-up of droplets in a concentrated emulsion flowing through a narrow constriction** *SOFT MATTER*
Rosenfeld, L., Fan, L., Chen, Y., Swoboda, R., Tang, S. K.
2014; 10 (3): 421-430
 - **Filter-based assay for Escherichia coli in aqueous samples using bacteriophage-based amplification.** *Analytical chemistry*
Derda, R., Lockett, M. R., Tang, S. K., Fuller, R. C., Maxwell, E. J., Breiten, B., Cuddemi, C. A., Ozdogan, A., Whitesides, G. M.
2013; 85 (15): 7213-7220
 - **Prospective identification of parasitic sequences in phage-display screens** *Nucleic Acids Research*
Matochko, W., Li, C., Tang, Sindy, K.Y., Derda, R.
2013
 - **Single particle detection in CMOS compatible photonic crystal nanobeam cavities** *Optics Express*
Quan, Q., Floyd, Daniel, L., Burgess, Ian, B., Deotare, Parag, B., Frank, Ian, W., Tang, Sindy, K.Y.
2013; 21: 32225-32233
 - **Characterization of sensitivity and specificity in leaky droplet-based assays.** *Lab on a chip*
Chen, Y., Wijaya Gani, A., Tang, S. K.
2012; 12 (23): 5093-5103
 - **Uniform amplification of phage display libraries in monodisperse emulsions** *METHODS*
Matochko, W. L., Ng, S., Jafari, M. R., Romaniuk, J., Tang, S. K., Derda, R.
2012; 58 (1): 18-27
 - **Characterization of sensitivity and specificity in leaky droplet-based assays** *LAB ON A CHIP*
Chen, Y., Gani, A. W., Tang, S. K.
2012; 12 (23): 5093-5103
 - **High-Q, Low Index-Contrast Polymeric Photonic Crystal Nanobeam Cavities** *Conference on Lasers and Electro-Optics (CLEO)*
Quan, Q., Burgess, I. B., Tang, S. K., Floyd, D. L., Loncar, M.
IEEE.2012
 - **High-Q, low index-contrast polymeric photonic crystal nanobeam cavities** *OPTICS EXPRESS*
Quan, Q., Burgess, I. B., Tang, S. K., Floyd, D. L., Loncar, M.
2011; 19 (22): 22191-22197

- **Bioinspired self-repairing slippery surfaces with pressure-stable omniphobicity** *NATURE*
Wong, T., Kang, S. H., Tang, S. K., Smythe, E. J., Hatton, B. D., Grinthal, A., Aizenberg, J.
2011; 477 (7365): 443-447
- **Denaturation of Proteins by SDS and Tetraalkylammonium Dodecyl Sulfates** *LANGMUIR*
Lee, A., Tang, S. K., Mace, C. R., Whitesides, G. M.
2011; 27 (18): 11560-11574
- **Reconfigurable Self-Assembly of Mesoscale Optical Components at a Liquid-Liquid Interface** *ADVANCED MATERIALS*
Tang, S. K., Derda, R., Mazzeo, A. D., Whitesides, G. M.
2011; 23 (21): 2413-?
- **Multizone Paper Platform for 3D Cell Cultures** *PLOS ONE*
Derda, R., Tang, S. K., Laromaine, A., Mosadegh, B., Hong, E., Mwangi, M., Mammoto, A., Ingber, D. E., Whitesides, G. M.
2011; 6 (5)
- **Externally Applied Electric Fields up to 1.6×10^5 V/m Do Not Affect the Homogeneous Nucleation of Ice in Supercooled Water** *JOURNAL OF PHYSICAL CHEMISTRY B*
Stan, C. A., Tang, S. K., Bishop, K. J., Whitesides, G. M.
2011; 115 (5): 1089-1097
- **Diversity of Phage-Displayed Libraries of Peptides during Panning and Amplification** *MOLECULES*
Derda, R., Tang, S. K., Li, S. C., Ng, S., Matochko, W., Jafari, M. R.
2011; 16 (2): 1776-1803
- **Continuously tunable microdroplet-laser in a microfluidic channel** *OPTICS EXPRESS*
Tang, S. K., Derda, R., Quan, Q., Loncar, M., Whitesides, G. M.
2011; 19 (3): 2204-2215
- **Cytoplasmic self-organization of internal membranes, microtubule- and actin-cytoskeleton inside microfluidics generated droplets** *Annual Meeting of the American-Society-for-Cell-Biology (ASCB)*
Tang, S., Renz, M., Driscoll, M., REBER, S., Nguyen, A., Daniels, B., Field, C., Lippincott-Schwartz, J.
AMER SOC CELL BIOLOGY.2011
- **Slippery surfaces with omniphobicity, self-repair, high-pressure stability and optical transparency** *Nature*
Wong, T., Kang, S. H., Tang, S. K., Smythe, E., Hatton, B., Grinthal, A.
2011; 447: 443
- **Monte Carlo simulation of centrosomal self-centering due to pushing by microtubules in large cells.** *Annual Meeting of the American-Society-for-Cell-Biology (ASCB)*
Tang, S. K., Castle, B. T., Odde, D. J.
AMER SOC CELL BIOLOGY.2011
- **Cofabrication: A Strategy for Building Multicomponent Microsystems** *ACCOUNTS OF CHEMICAL RESEARCH*
Siegel, A. C., Tang, S. K., Nijhuis, C. A., Hashimoto, M., Phillips, S. T., Dickey, M. D., Whitesides, G. M.
2010; 43 (4): 518-528
- **Uniform Amplification of Phage with Different Growth Characteristics in Individual Compartments Consisting of Monodisperse Droplets** *ANGEWANDTE CHEMIE-INTERNATIONAL EDITION*
Derda, R., Tang, S. K., Whitesides, G. M.
2010; 49 (31): 5301-5304
- **Paper-supported 3D cell culture for tissue-based bioassays** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Derda, R., Laromaine, A., Mammoto, A., Tang, S. K., Mammoto, T., Ingber, D. E., Whitesides, G. M.
2009; 106 (44): 18457-18462
- **Independent Control of Drop Size and Velocity in Microfluidic Flow-Focusing Generators Using Variable Temperature and Flow Rate** *ANALYTICAL CHEMISTRY*
Stan, C. A., Tang, S. K., Whitesides, G. M.

2009; 81 (6): 2399-2402

- **A multi-color fast-switching microfluidic droplet dye laser** *LAB ON A CHIP*

Tang, S. K., Li, Z., Abate, A. R., Agresti, J. J., Weitz, D. A., Psaltis, D., Whitesides, G. M.

2009; 9 (19): 2767-2771

- **Basic Microfluidic and Soft Lithographic Techniques** *Optofluidics: Fundamentals, Devices, and Applications*

Tang, Sindy, K.Y., Whitesides, George, M.

McGraw-Hill.2009

- **Optical Components Based on Dynamic Liquid-liquid Interfaces** *Optofluidics: Fundamentals, Devices, and Applications*

Tang, Sindy, K.Y., Whitesides, George, M.

McGraw-Hill.2009

- **Dynamically reconfigurable liquid-core liquid-cladding lens in a microfluidic channel** *LAB ON A CHIP*

Tang, S. K., Stan, C. A., Whitesides, G. M.

2008; 8 (3): 395-401

- **Optical waveguiding using thermal gradients across homogeneous liquids in microfluidic channels** *APPLIED PHYSICS LETTERS*

Tang, S. K., Mayers, B. T., Vezenov, D. V., Whitesides, G. M.

2006; 88 (6)